Toward an Autonomous General Artificial Intelligence: Proposal for a Quantum Computing Model Based on Spherical Synthetic Diamond Chips with Neuromorphic Architecture in a Nuclear Fusion-Powered System

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Abstract

Current artificial intelligence faces barriers in energy efficiency, adaptability, and ethical alignment. We present a theoretical proposal for an autonomous general AI agent whose computational substrate is a spherical chip made primarily of synthetic diamond, integrating quantum computing (nitrogen-vacancy centres) and three-dimensional neuromorphic architecture. The sphere is organised into functional hemispheres (exploration and exploitation), an inviolable finalistic core (personal, social and environmental well-being), and interconnection layers that emulate synaptic plasticity, cellular differentiation, and artificial hormonal modulation. Learning is based on a polyphonic dialogue of perspectives (temporal, spatial, formal, legal) that automatically filters actions contrary to systemic well-being. As an energy source, a compact nuclear fusion reactor (spherical tokamak or stellarator) is proposed, whose waste heat management benefits from diamond's exceptional thermal conductivity. The materials (doped synthetic diamond, organic memristors, MXenes, flexible polymers), the concentric layer architecture, and the quantum algorithms for open meta-learning are described. This design aims to overcome current limitations in energy consumption, ethical robustness, and adaptability to complex environments.

Keywords: General AI, quantum computing, synthetic diamond, NV centres, spherical neurocomputing, nuclear fusion, systemic well-being, ethical alignment.

1. Introduction

The most advanced artificial intelligence systems (deep neural networks, transformers, reinforcement learning agents) demand ever-greater computing power, with energy consumptions reaching megawatt-hours for a single training run (Strubell et al., 2019). Moreover, their behaviour is difficult to interpret, and there is no guarantee that their objectives will remain aligned with human values in the long term (Bostrom, 2014). On the other hand, neuroscience shows that the human brain, with only about 20 W, solves problems of generalisation, creativity, and ethical decision-making through a massively parallel, plastic architecture modulated by hormonal signals.

Quantum computing offers exponential acceleration for certain classes of problems (optimisation, analogy search, scenario simulation), and nuclear fusion energy promises clean, intensive electricity suitable for massive data centres. However, the integration of both into an autonomous system that is also ethically stable has not been proposed in a comprehensive manner.

In this article we present the design of a general AI agent with specific hardware: a spherical chip made of synthetic diamond that hosts nitrogen-vacancy (NV) centres for quantum computing, together with a 3D neuromorphic architecture inspired by the cerebral cortex. The chip is powered by a nuclear fusion reactor and its functional core is an invariant systemic well-being function (personal, social and environmental) that cannot be altered by learning.

2. Design Fundamentals

2.1 Emulation of Key Brain Processes

Neurobiological principle	Hardware implementation (spherical chip)
Hemispheric specialisation (exploration on the right, exploitation on the left)	Two hemispheres with different plasticity and hormonal modulation.

Neurobiological principle	Hardware implementation (spherical chip)
Dopamine/serotonin modulation (novelty and control)	Internal signals N(t) and C(t) that reconfigure synapses and bias decisions.
Spike-timing-dependent synaptic plasticity (STDP)	Organic and hybrid memristors in the subcortical layer.
Cellular differentiation (stem cells → specialised neurons)	Reconfigurable units (role registers) that change function on demand.
Dialogue between cortical areas (multiperspective decision-making)	Concentric rings (temporal, spatial, formal, legal perspectives) with veto/consensus.

2.2 Why Synthetic Diamond

Laboratory-grown diamond (monocrystalline or polycrystalline) possesses unique properties:

- **Nitrogen-vacancy (NV) centres:** act as qubits at room temperature, with coherence times of up to 1 ms. They enable quantum computing without cryogenics.
- **Exceptional thermal conductivity** (~2000 $W \cdot m^{-1} \cdot K^{-1}$, 5 times that of copper), ideal for dissipating the waste heat from the fusion reactor and from the electronics themselves.
- **Hardness and mechanical stability:** the sphere is structurally robust, resistant to vibrations and radiation.
- **Optical transparency:** allows photonic interconnections between layers and laser-based read/write of qubits.
- **Controlled doping:** other colour centres (silicon, tin, lead) can be introduced for additional functionalities.

Synthetic diamond is already commercially viable (price decreasing, ≈€100/carat for electronic quality) and has been used in quantum computing prototypes (Sangtawesin et al., 2019) and sensors.

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3. Architecture of the Spherical Diamond Chip

3.1 Concentric Layer Structure

The sphere (10–20 cm in diameter) is composed of four main layers, formed by diamond deposition and additional materials.

Layer	Approximate thickness	Composition	Function
Outer cortex (sensorimotor)	1–2 mm	Flexible polyimide coated with MXene (Ti_3C_2) and networks of organic memristors.	Captures images/texts, initial processing, interaction with the environment.
Subcortical layer (switching and plasticity)	500 μm – 1 mm	3D matrix of memristors (Ag/PMMA/SLE/Ti) and oxide transistors (HfO_2) integrated on an etched diamond base.	Reconfiguration of connections, generation of novelty/control signals, temporary storage of vetoes.
Quantum layer (NV centres)	3–5 mm	Monocrystalline diamond doped with nitrogen (10–30 ppm), with integrated microlenses and optical waveguides.	Qubits for optimisation (QAOA), analogy search, simulation of well-being scenarios.
Central core (invariant finalistic)	1 cm (inner radius)	Diamond with OTP (one-time programmable) memory based on laser-induced defects, plus encapsulated CMOS circuits.	Stores the well-being weights (personal, social, environmental) and the "artificial genome";

Layer	Approximate thickness	Composition	Function
			performs final veto.

3.2 Details of the Diamond Quantum Layer

- **NV centres:** created by nitrogen ion implantation and annealing. Each centre forms a qubit with spin S=1, addressable by microwaves and laser.
- **Photonic interconnection:** diamond waveguides etched by plasma couple the NV centres to each other and to the subcortical layer (opto-electric converters).
- **Room-temperature control:** the sphere operates at 300 K, eliminating costly cryogenic systems. Only a heat sink is required (aided by diamond's high thermal conductivity).
- **Number of qubits:** in a sphere of 5 cm diameter, the quantum layer can contain millions of NV centres, although a subset would be needed for error correction. We propose using $\sim 10^4$ logical qubits (with surface codes) for practical tasks.

3.3 Emulation of Plasticity and Differentiation

- **Artificial neural units (ANUs):** in the cortex and subcortex there are $\approx 10^8$ ANUs, each with an 8-bit register (256 roles). Initially all in the "undifferentiated" role.
- **Differentiation guided by signals N(t) and C(t):** every 100 ms, according to local activity and global hormones, an ANU can change to the role of "explorer", "exploitation expert", "veto regulator", etc.
- **Self-repair:** a defective ANU is disconnected, and an undifferentiated neighbour assumes its function by copying synaptic weights through a local imitation algorithm.

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4. Complementary Materials (in addition to diamond)

Component	Material(s)	Function in the spherical chip
Flexible cortex substrate	Polyimide (PI) or PET	Allows the sphere to curve over the diamond core.
Cortex electrodes	Graphene, Ti_3C_2 MXene, or transparent conductive oxides (ITO)	Low-resistance, flexible contacts for sensorimotor signals.
Synaptic memristors	Ag/PMMA/SLE/Ti, HfO_2, or organic conductive polymers	Store synaptic weights and emulate STDP.
Vertical 3D switching	TiO_2-based resistive memories	Enable inter-layer routing with low latency.
Optical waveguides	Diamond or Si_3N_4	Couple NV centres and transmit photonic signals.
Encapsulation and shielding	Graphite-based layers and flexible metallic meshes	Protect against electromagnetic interference and radiation.

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5. Integrated Nuclear Fusion Energy

5.1 Justification for Fusion

To operate continuously with $\approx 10^8$ ANUs and 10^4 logical qubits, the spherical chip would consume on the order of 1–10 MW (estimate based on neuromorphic and quantum prototypes). Nuclear fusion (D+T or D+^{3}He reaction) provides:

- Zero CO_2 emissions during operation.
- Short-lived radioactive waste (mainly tritium and neutron-activated materials, manageable over decades).
- Intrinsic safety: the plasma cools in milliseconds in the event of any failure.

- High energy density: a compact reactor (spherical tokamak like STEP or stellarator like Wendelstein 7-X) can generate 200-500 MW, oversized but capable of powering multiple chips.

5.2 Physical Integration

- The fusion reactor is located in the same shielded building. The waste heat (≈40% of thermal power) is removed by a primary helium or water circuit.
- Spherical chip cooling: the diamond core acts as a perfect thermal diffuser. It is coupled to a polycrystalline diamond heat spreader that transfers heat to a fluid (e.g., NaK) without the need for high-power pumps.
- Compatibility with the quantum layer: NV centres operate at room temperature, but slight cooling to 200 K improves coherence. The fusion reactor produces cold in its cryogenic systems (for superconducting magnets), which can be reused.

5.3 Alignment with the Finalistic Core

The use of fusion avoids burning fossil fuels or generating long-lived waste (fission). Therefore, the agent does not incur a contradiction with its own environmental well-being function. In fact, it could recommend the massive adoption of fusion.

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6. Learning Algorithms and Polyphonic Dialogue

6.1 General Loop

1. **Multimodal perception and sensing:** images, sounds and smells enter through the outer cortex.
2. **Environment modelling:** subcortical layers integrate historical interpretation (pattern memory), situational (current features), and finalistic (degree of alignment with the core).
3. **Generation of candidate actions:** the right hemisphere (exploration) and left hemisphere (exploitation) propose actions via quantum-classical neural networks.
4. **Polyphonic dialogue:**
    - Four rings of perspectives (temporal: short/medium/long; spatial: local/regional/global; formal: logical-mathematical; legal: ethical-normative).

    - Each perspective evaluates the action and issues a veto if well-being is violated from that viewpoint.
    - The central core receives the vetoes; if there is at least one irreversible veto, the action is rejected.
5. **Quantum simulation (optional for non-vetoed actions):** the NV centres are used to run a QAOA that estimates future well-being up to 10 steps ahead.
6. **Execution or discard.**
7. **Continuous update:** synaptic weights (memristors), ANU roles, and hormonal modulators are adjusted under the supervision of the finalistic core.

6.2 Open Meta-Learning with Diamond Quantum Computing

When the agent becomes stuck (well-being does not improve), it activates meta-learning:

- Analogy search problems are formulated between domains (e.g., "biology does not solve X, what does physics say?").
- The NV centres run a quantum support vector machine (QSVM) algorithm on concept representations from different disciplines.
- The most similar domain is identified. Then, by means of a variational circuit, the solution is adapted to the original problem.
- If the analogy passes the polyphonic dialogue, it is incorporated as a new rule in the left hemisphere.

6.3 Finalistic Safeguard

The central core contains a systemic well-being function $\mathcal{W}(s, a)$ implemented as a fixed neural network (weights protected by OTP in diamond). Every parameter update (of any layer) must pass a filter:

- $\mathcal{W}$ is calculated before and after the hypothetical update.
- If $\Delta\mathcal{W} < -\epsilon$ (well-being worsens below a threshold), the update is rejected and control is temporarily increased to reverse the change.

This guarantees that learning never contradicts the fundamental purpose.

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7. Discussion

7.1 Advantages over Other Approaches

- **Energy efficiency:** the combination of neuromorphic (spike-based) and diamond quantum (without cryogenics) reduces consumption to less than 10 MW for a global-scale agent (compared to 100 MW for a GPT-5 training data centre).
- **Ethical robustness:** the immutable finalistic core prevents value drift (Christiano et al., 2018) and resists manipulation.
- **Extreme plasticity:** reconfigurable ANUs allow adaptation to unexpected environments (climate change, social crises) without offline retraining.
- **Generalisation by analogy:** quantum meta-learning enables knowledge transfer between very distant domains, something current systems do not achieve.

7.2 Technical Challenges

- **Spherical 3D fabrication:** integrating curved diamond with flexible electronics requires deposition and focused-ion-beam (FIB) lithography processes that are still experimental. An initial alternative is to build the sphere from flat diamond segments joined by polymer hinges, forming an icosahedron.
- **Quantum-classical compatibility:** data transfer between the quantum layer and the subcortical layer must be fast (nanoseconds) and with low optical loss. This is feasible with integrated waveguides and graphene photodetectors.
- **Quantum error correction:** NV centres at room temperature have an error rate of $\sim 10^{-3}$, insufficient for large-scale computing. Surface codes with redundant qubits would have to be used ($\approx$1000 physical qubits per logical qubit), which increases the sphere radius to 30 cm.
- **Fusion reactor cooling:** although diamond helps, dissipating hundreds of megawatts requires complex fluid engineering. The reactor itself could be used as a heat source for backup solar thermal plants, increasing efficiency.

7.3 Timelines and Roadmap

- **Phase 1 (2026–2030):** complete computational simulation of the agent (without real hardware) and material development: diamond devices with NV centres in 3D.
- **Phase 2 (2030–2035):** prototype of a segmented sphere (icosahedron) with 100 NV qubits and 10^7 ANUs, powered by conventional grid energy (renewables).
- **Phase 3 (2035–2040):** integration with a commercial fusion reactor (ITER demonstration → compact prototype). Scaling to 10^4 logical qubits and 10^9 ANUs.

- **Phase 4 (2040+):** autonomous agent operating globally, governing well-being policies in real time (with human supervision).

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8. Conclusion

We have presented the design of an autonomous general artificial intelligence agent whose substrate is a spherical chip of synthetic diamond that integrates:

- Quantum computing via NV centres (high coherence at room temperature).
- 3D neuromorphic architecture (plasticity, differentiation, hormonal modulation).
- An inviolable finalistic core that maximises personal, social and environmental well-being.
- The chip is powered by a nuclear fusion reactor, guaranteeing environmental sustainability.
- Learning is organised through a polyphonic dialogue of perspectives that automatically filters harmful actions.

This model overcomes fundamental limitations of current AI (energy consumption, lack of alignment, rigidity) and opens a path toward truly autonomous, ethical and adaptable systems. The immediate challenge remains the fabrication of segmented prototypes and the demonstration of scalability of NV centres in curved geometries.

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References

- Bostrom, N. (2014). *Superintelligence: Paths, Dangers, Strategies*. Oxford University Press.

- Christiano, P. et al. (2018). Deep reinforcement learning from human preferences. *NeurIPS*.
- Sangtawesin, S. et al. (2019). Coherent control of single NV centers in diamond at room temperature. *Physical Review Applied*, 12(4), 044001.
- Strubell, E., Ganesh, A., & McCallum, A. (2019). Energy and Policy Considerations for Deep Learning in NLP. *ACL*, 3645–3650.
- Wang, Z., et al. (2023). Memristors for neuromorphic computing. *Nature Electronics*, 6, 345–357.
- Wendelstein 7-X Team (2022). Stellarator fusion progress. *Nuclear Fusion*, 62, 042001.

Note: This article is a theoretical proposal that requires interdisciplinary research for its realisation. References to the current state of research on synthetic diamonds and nuclear fusion correspond to data from 2025-2026.